



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 2, 2025 – 02:43 am GMT

PDB ID : 5FF3 / pdb_00005ff3
Title : HydE from *T. maritima* in complex with 4R-TCA
Authors : Rohac, R.; Amara, P.; Benjdia, A.; Martin, L.; Ruffie, P.; Favier, A.; Bertheau, O.; Mouesca, J.M.; Fontecilla-Camps, J.C.; Nicolet, Y.
Deposited on : 2015-12-17
Resolution : 1.18 Å (reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 1.8.4, CSD as541be (2020)
Xtrriage (Phenix) : 2.0
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.46

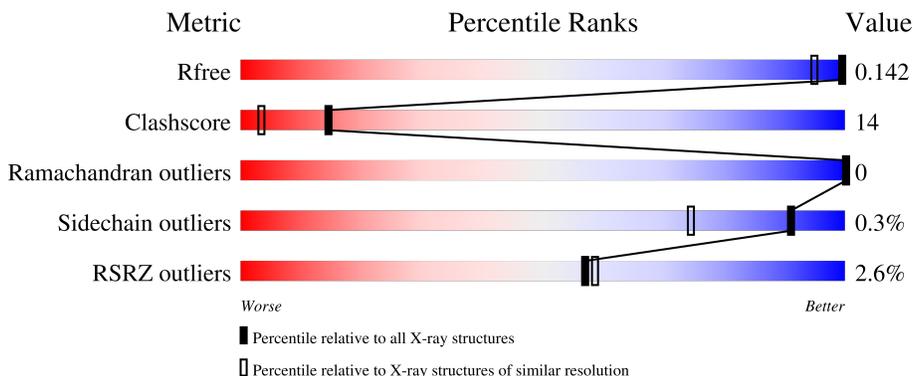
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.18 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1569 (1.20-1.16)
Clashscore	180529	1711 (1.20-1.16)
Ramachandran outliers	177936	1657 (1.20-1.16)
Sidechain outliers	177891	1657 (1.20-1.16)
RSRZ outliers	164620	1568 (1.20-1.16)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	348	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
1	OTY	A	114[A]	-	-	X	-

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Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
1	OTY	A	114[B]	-	-	X	-

2 Entry composition [i](#)

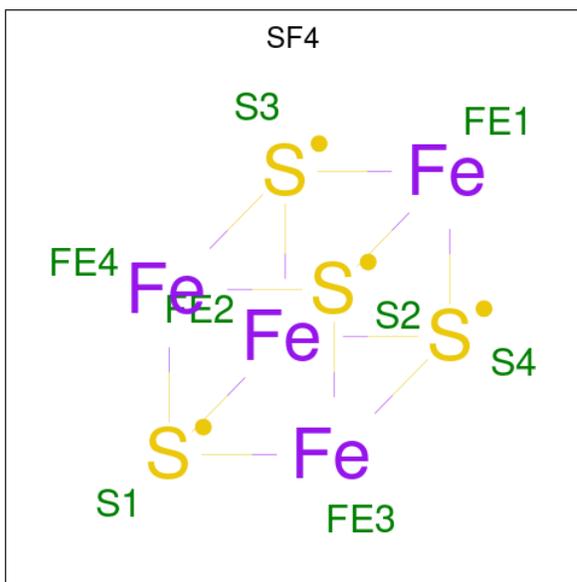
There are 9 unique types of molecules in this entry. The entry contains 3735 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called [FeFe] hydrogenase maturase subunit HydE.

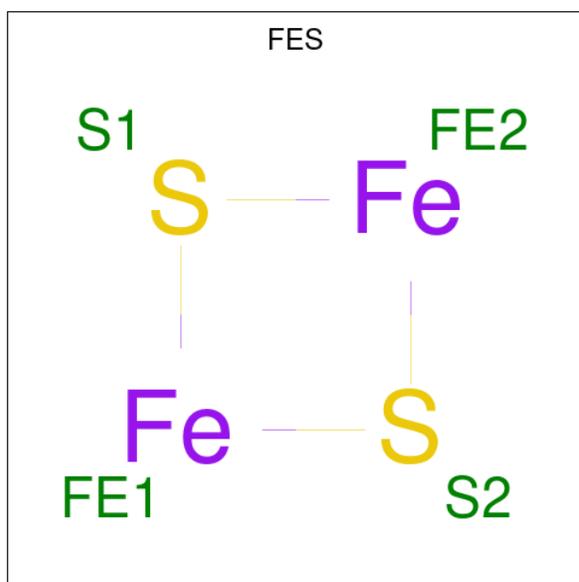
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	347	3045	1940	520	560	25	0	39	0

- Molecule 2 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄).



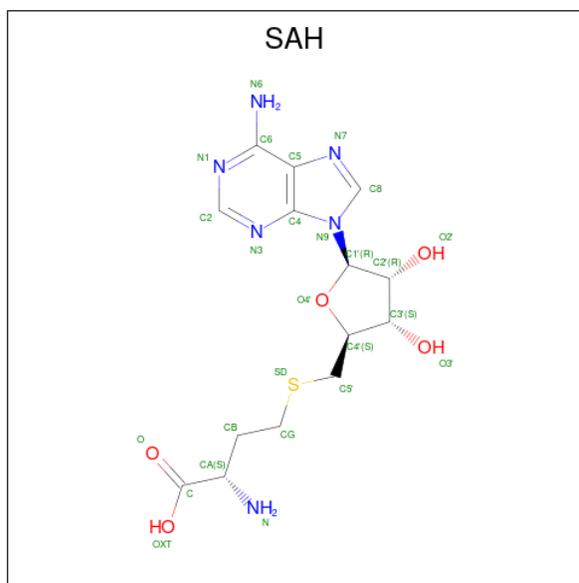
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Fe S		
2	A	1	8	4 4	0	1

- Molecule 3 is 3-[(3-CHOLAMIDOPROPYL)DIMETHYLAMMONIO]-1-PROPANESULFONATE (CCD ID: CPS) (formula: C₃₂H₅₈N₂O₇S).



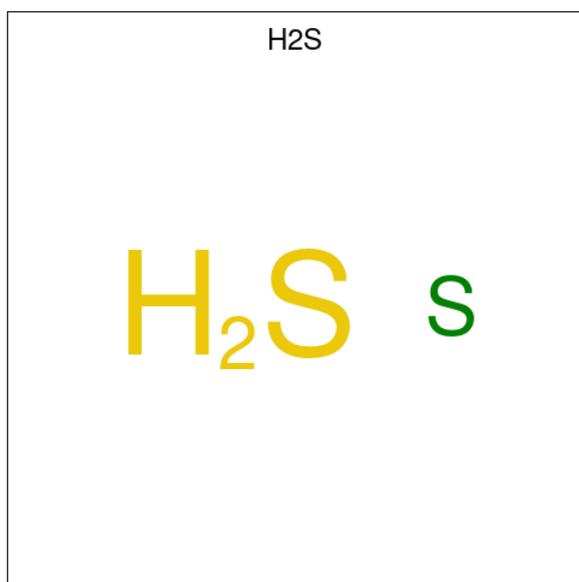
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
5	A	1	4	2	2	0	1

- Molecule 6 is S-ADENOSYL-L-HOMOCYSTEINE (CCD ID: SAH) (formula: $C_{14}H_{20}N_6O_5S$).



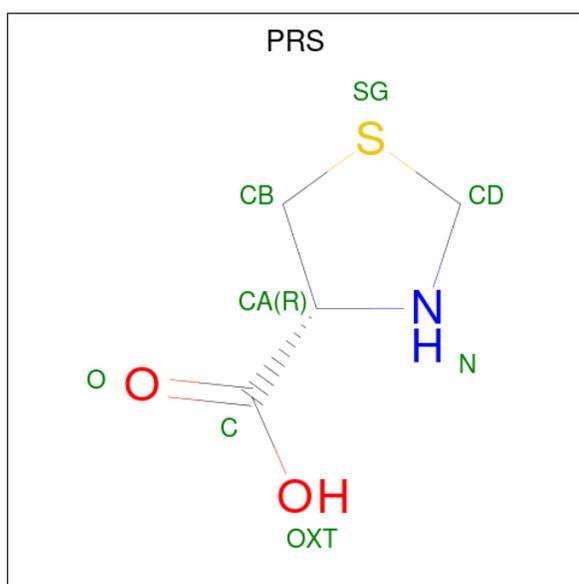
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
6	A	1	26	14	6	5	1	0	0

- Molecule 7 is HYDROSULFURIC ACID (CCD ID: H2S) (formula: H_2S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total S 1 1	0	1
7	A	1	Total S 1 1	0	1

- Molecule 8 is THIOPROLINE (CCD ID: PRS) (formula: C₄H₇NO₂S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C N O S 8 4 1 2 1	0	0

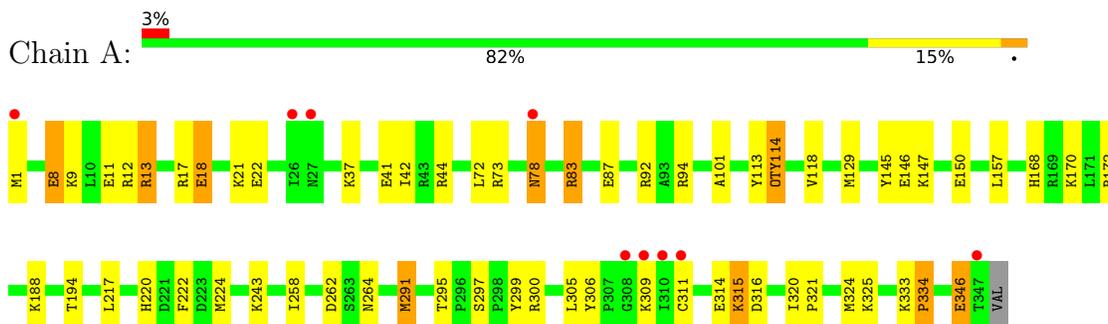
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	445	Total 448	O 448	0	14

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: [FeFe] hydrogenase maturase subunit HydE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	51.00Å 79.19Å 86.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.90 – 1.18 43.90 – 1.18	Depositor EDS
% Data completeness (in resolution range)	99.7 (43.90-1.18) 99.6 (43.90-1.18)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.99 (at 1.18Å)	Xtrriage
Refinement program	REFMAC 5.8.0131	Depositor
R, R_{free}	0.118 , 0.142 0.118 , 0.142	Depositor DCC
R_{free} test set	5384 reflections (4.69%)	wwPDB-VP
Wilson B-factor (Å ²)	10.6	Xtrriage
Anisotropy	0.543	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 50.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	3735	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.88% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality i

5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: SAH, PRS, OTY, CPS, CL, SF4, H2S, FES

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	1.36	19/3122 (0.6%)	1.13	7/4210 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	21	LYS	C-O	-7.47	1.15	1.24
1	A	334[B]	PRO	C-N	-7.21	1.27	1.33
1	A	22[A]	GLU	C-O	-6.54	1.16	1.24
1	A	22[B]	GLU	C-O	-6.54	1.16	1.24
1	A	291[A]	MET	CA-C	6.49	1.59	1.52
1	A	291[B]	MET	CA-C	6.49	1.59	1.52
1	A	101	ALA	C-O	-6.34	1.16	1.23
1	A	297	SER	CB-OG	-6.17	1.29	1.42
1	A	334[B]	PRO	CA-C	5.82	1.59	1.52
1	A	18	GLU	C-O	-5.73	1.17	1.24
1	A	11	GLU	C-O	-5.61	1.17	1.24
1	A	18	GLU	CG-CD	5.50	1.65	1.52
1	A	13	ARG	CZ-NH2	5.44	1.40	1.33
1	A	8	GLU	C-O	-5.41	1.17	1.24
1	A	73	ARG	NE-CZ	5.39	1.39	1.33
1	A	333	LYS	CA-C	-5.34	1.47	1.52
1	A	78[A]	ASN	C-O	5.16	1.31	1.24
1	A	78[B]	ASN	C-O	5.16	1.31	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	17	ARG	C-O	-5.09	1.18	1.24

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	78[A]	ASN	CA-C-O	5.92	126.88	119.59
1	A	78[B]	ASN	CA-C-O	5.92	126.88	119.59
1	A	78[A]	ASN	N-CA-C	5.52	119.11	112.93
1	A	78[B]	ASN	N-CA-C	5.52	119.11	112.93
1	A	315	LYS	CA-C-N	5.34	131.73	121.54
1	A	315	LYS	C-N-CA	5.34	131.73	121.54
1	A	72	LEU	CB-CG-CD2	5.24	126.43	110.70

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	78[A]	ASN	Mainchain
1	A	78[B]	ASN	Mainchain
1	A	83[B]	ARG	Mainchain

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3045	0	3025	81	1
2	A	8	0	0	0	0
3	A	192	0	264	14	0
4	A	2	0	0	1	0
5	A	4	0	0	0	0
6	A	26	0	19	0	0
7	A	2	0	0	0	0
8	A	8	0	6	1	0
9	A	448	0	0	28	2
All	All	3735	0	3314	92	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including

hydrogen atoms). The all-atom clashscore for this structure is 14.

All (92) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:113[A]:TYR:HE2	1:A:114[A]:OTY:CE1	1.22	1.48
1:A:113[A]:TYR:CE2	1:A:114[A]:OTY:CE1	1.96	1.47
1:A:113[A]:TYR:CE2	1:A:114[A]:OTY:H9	1.53	1.43
1:A:83[B]:ARG:CG	1:A:114[B]:OTY:OH	1.74	1.35
1:A:300[B]:ARG:NH1	1:A:316[B]:ASP:HA	1.43	1.32
1:A:83[B]:ARG:HG3	1:A:114[B]:OTY:OH	1.03	1.20
1:A:309[B]:LYS:HG3	9:A:729:HOH:O	1.43	1.19
1:A:83[B]:ARG:HG3	1:A:114[B]:OTY:CZ	1.79	1.13
1:A:324[B]:MET:HE3	3:A:406[B]:CPS:C11	1.81	1.11
1:A:113[A]:TYR:CD2	1:A:114[A]:OTY:CD1	2.41	1.02
1:A:113[A]:TYR:CD2	1:A:114[A]:OTY:CE1	2.47	0.98
1:A:113[A]:TYR:CE2	1:A:114[A]:OTY:CD1	2.51	0.93
1:A:324[B]:MET:CE	3:A:406[B]:CPS:C11	2.47	0.93
1:A:300[B]:ARG:HH11	1:A:316[B]:ASP:CA	1.83	0.91
1:A:83[B]:ARG:HG3	1:A:114[B]:OTY:H11	1.13	0.91
1:A:145:TYR:C	1:A:146[B]:GLU:CA	2.44	0.91
1:A:324[B]:MET:HE3	3:A:406[B]:CPS:H11	1.53	0.90
1:A:300[B]:ARG:HH11	1:A:316[B]:ASP:HA	0.99	0.89
1:A:83[B]:ARG:HG2	1:A:114[B]:OTY:OH	1.78	0.84
1:A:113[A]:TYR:HD2	1:A:114[A]:OTY:CD1	1.93	0.80
1:A:146[B]:GLU:CA	1:A:147:LYS:N	2.44	0.80
1:A:170:LYS:HG3	9:A:632:HOH:O	1.80	0.79
1:A:324[B]:MET:CE	3:A:406[B]:CPS:H11B	2.11	0.77
1:A:113[A]:TYR:HE2	1:A:114[A]:OTY:H9	0.60	0.76
1:A:300[B]:ARG:NH1	1:A:316[B]:ASP:CA	2.37	0.74
1:A:300[B]:ARG:HH12	1:A:316[B]:ASP:HA	1.50	0.74
1:A:83[B]:ARG:HG3	1:A:114[B]:OTY:CE1	2.17	0.74
1:A:1:MET:O	9:A:501:HOH:O	2.04	0.74
1:A:291[A]:MET:SD	9:A:829:HOH:O	2.45	0.73
1:A:316[A]:ASP:OD2	9:A:502:HOH:O	2.08	0.71
1:A:321:PRO:HB3	3:A:406[A]:CPS:H11A	1.70	0.71
1:A:87:GLU:HG2	9:A:835:HOH:O	1.90	0.70
1:A:157:LEU:HD23	1:A:224[A]:MET:HE2	1.75	0.68
1:A:316[B]:ASP:HB3	9:A:589:HOH:O	1.94	0.67
1:A:300[B]:ARG:HD3	9:A:602:HOH:O	1.94	0.67
1:A:324[B]:MET:HE2	3:A:406[B]:CPS:H11B	1.76	0.67
1:A:243[A]:LYS:HE2	9:A:685:HOH:O	1.95	0.65
1:A:300[B]:ARG:NH2	1:A:314:GLU:HB2	2.12	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:41[B]:GLU:HG2	9:A:724:HOH:O	1.96	0.65
1:A:92:ARG:HH12	1:A:316[A]:ASP:HB3	1.64	0.63
1:A:168:HIS:HE1	1:A:172:ARG:HH11	1.44	0.62
1:A:306:TYR:H	1:A:309[B]:LYS:HE3	1.63	0.62
1:A:8:GLU:HG2	1:A:12:ARG:NH1	2.15	0.61
1:A:300[B]:ARG:HH22	1:A:314:GLU:HB2	1.65	0.61
1:A:334[B]:PRO:CB	9:A:676:HOH:O	2.49	0.61
1:A:37[B]:LYS:CD	9:A:900:HOH:O	2.49	0.61
1:A:83[B]:ARG:CG	1:A:114[B]:OTY:CZ	2.61	0.60
1:A:157:LEU:CD2	1:A:224[A]:MET:HE2	2.32	0.60
1:A:188[B]:LYS:CG	9:A:607:HOH:O	2.50	0.59
1:A:44:ARG:CZ	9:A:511:HOH:O	2.50	0.59
1:A:295:THR:O	1:A:300[B]:ARG:HG3	2.04	0.58
1:A:1:MET:SD	1:A:9:LYS:NZ	2.74	0.58
1:A:44:ARG:NH2	9:A:511:HOH:O	2.36	0.57
1:A:300[B]:ARG:NH2	1:A:311:CYS:O	2.32	0.56
1:A:168:HIS:CE1	1:A:172:ARG:HH11	2.23	0.56
1:A:243[A]:LYS:CE	9:A:685:HOH:O	2.54	0.55
1:A:309[B]:LYS:HD2	9:A:621:HOH:O	2.08	0.54
1:A:217:LEU:HD11	9:A:514:HOH:O	2.08	0.54
3:A:406[A]:CPS:H4	3:A:406[A]:CPS:H21A	1.90	0.54
1:A:300[B]:ARG:NH1	1:A:315:LYS:O	2.40	0.51
3:A:403:CPS:H4	3:A:403:CPS:H21A	1.92	0.51
1:A:243[A]:LYS:HG3	9:A:685:HOH:O	2.11	0.50
1:A:168:HIS:CE1	1:A:172:ARG:HD3	2.48	0.49
1:A:83[B]:ARG:CG	1:A:114[B]:OTY:H11	1.91	0.49
1:A:18:GLU:HB2	9:A:708:HOH:O	2.12	0.48
1:A:188[B]:LYS:CG	9:A:864:HOH:O	2.61	0.48
4:A:408:CL:CL	8:A:413:PRS:HD3	2.52	0.47
1:A:300[B]:ARG:HH11	1:A:316[B]:ASP:CB	2.28	0.47
1:A:299[A]:TYR:HE2	9:A:538:HOH:O	1.99	0.46
1:A:320:ILE:HG23	1:A:324[A]:MET:HE3	1.98	0.46
1:A:305:LEU:H	1:A:309[B]:LYS:HZ2	1.63	0.46
1:A:220:HIS:HB2	1:A:222:PHE:CE2	2.50	0.46
1:A:13:ARG:NH1	1:A:346:GLU:OE1	2.49	0.46
1:A:157:LEU:HD23	1:A:224[A]:MET:CE	2.44	0.46
1:A:150[B]:GLU:HG3	9:A:816:HOH:O	2.15	0.45
3:A:406[B]:CPS:H21A	3:A:406[B]:CPS:H4	1.99	0.45
1:A:83[B]:ARG:HG3	1:A:114[B]:OTY:H9	1.98	0.45
3:A:403:CPS:H21B	3:A:403:CPS:H23	1.86	0.44
1:A:194[A]:THR:HG21	9:A:607:HOH:O	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:291[A]:MET:HE3	9:A:895[A]:HOH:O	2.17	0.44
1:A:94:ARG:HG3	1:A:129[B]:MET:SD	2.58	0.43
3:A:402:CPS:H4	3:A:402:CPS:H21A	1.99	0.43
3:A:402:CPS:C24	3:A:402:CPS:H21B	2.48	0.43
1:A:42[A]:ILE:HD12	1:A:258:ILE:HG12	2.02	0.42
1:A:157:LEU:CD2	1:A:224[A]:MET:CE	2.97	0.42
1:A:224[B]:MET:HA	1:A:264:ASN:O	2.20	0.41
1:A:262:ASP:OD1	9:A:503[A]:HOH:O	2.22	0.41
1:A:114[A]:OTY:CD1	1:A:118:VAL:HG11	2.50	0.41
3:A:403:CPS:H23	3:A:403:CPS:H25A	1.80	0.41
3:A:405:CPS:H21A	3:A:405:CPS:H4	2.03	0.41

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:325[B]:LYS:NZ	9:A:787:HOH:O[4_555]	2.14	0.06
9:A:753:HOH:O	9:A:847:HOH:O[2_655]	2.17	0.03

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	382/348 (110%)	368 (96%)	14 (4%)	0	100 100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	328/303 (108%)	327 (100%)	1 (0%)	91 74

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	346	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	168	HIS
1	A	301	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

2 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
1	OTY	A	114[A]	1	11,12,14	2.60	3 (27%)	12,15,19	3.18	5 (41%)
1	OTY	A	114[B]	1	12,13,14	2.37	5 (41%)	14,17,19	1.80	4 (28%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '·' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	OTY	A	114[A]	1	-	3/5/6/8	0/1/1/1
1	OTY	A	114[B]	1	-	0/5/6/8	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	114[A]	OTY	CE2-CZ	5.46	1.49	1.38
1	A	114[B]	OTY	CD1-CG	-5.40	1.32	1.40
1	A	114[A]	OTY	CB-CG	4.77	1.62	1.51
1	A	114[B]	OTY	CD2-CG	3.48	1.45	1.39
1	A	114[B]	OTY	CE1-CZ	-3.01	1.34	1.39
1	A	114[A]	OTY	OH-CZ	2.49	1.42	1.37
1	A	114[B]	OTY	OD1-CD1	-2.15	1.32	1.36
1	A	114[B]	OTY	CB-CA	2.06	1.58	1.53

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	114[A]	OTY	CG-CB-CA	-6.14	101.67	114.10
1	A	114[A]	OTY	CB-CG-CD1	5.36	131.55	120.91
1	A	114[A]	OTY	CB-CG-CD2	-5.11	110.75	120.91
1	A	114[A]	OTY	CD1-CE1-CZ	-3.34	116.21	119.88
1	A	114[B]	OTY	OD1-CD1-CG	-3.16	110.77	118.89
1	A	114[B]	OTY	CB-CG-CD1	3.05	124.14	120.95
1	A	114[B]	OTY	CB-CA-C	-3.04	105.78	111.47
1	A	114[B]	OTY	OD1-CD1-CE1	3.01	127.53	119.46
1	A	114[A]	OTY	CE1-CD1-CG	2.75	124.81	121.03

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	114[A]	OTY	CA-CB-CG-CD2
1	A	114[A]	OTY	CA-CB-CG-CD1
1	A	114[A]	OTY	C-CA-CB-CG

There are no ring outliers.

2 monomers are involved in 18 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	114[A]	OTY	9	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	114[B]	OTY	9	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 14 ligands modelled in this entry, 2 are monoatomic and 2 are modelled with single atom - leaving 10 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	CPS	A	404	-	32,32,45	1.11	2 (6%)	51,51,70	1.07	4 (7%)
3	CPS	A	406[A]	-	28,28,45	1.83	9 (32%)	46,46,70	2.38	19 (41%)
3	CPS	A	406[B]	-	28,28,45	1.34	3 (10%)	46,46,70	1.94	10 (21%)
3	CPS	A	405	-	32,32,45	1.44	5 (15%)	51,51,70	1.59	9 (17%)
3	CPS	A	402	-	45,45,45	1.58	3 (6%)	69,70,70	1.21	6 (8%)
3	CPS	A	403	-	45,45,45	2.04	10 (22%)	69,70,70	2.71	21 (30%)
5	FES	A	409[A]	9,1	0,4,4	-	-	-	-	-
8	PRS	A	413	-	8,8,8	1.58	2 (25%)	8,10,10	1.77	3 (37%)
6	SAH	A	410	2	24,28,28	1.32	2 (8%)	25,40,40	1.50	4 (16%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	CPS	A	404	-	-	0/9/74/90	0/4/4/4
3	CPS	A	406[A]	-	-	0/4/69/90	0/4/4/4
3	CPS	A	406[B]	-	-	0/4/69/90	0/4/4/4

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	CPS	A	405	-	-	0/9/74/90	0/4/4/4
3	CPS	A	402	-	-	0/25/90/90	0/4/4/4
3	CPS	A	403	-	-	7/25/90/90	0/4/4/4
5	FES	A	409[A]	9,1	-	-	0/1/1/1
8	PRS	A	413	-	-	1/4/11/11	0/1/1/1
6	SAH	A	410	2	-	2/11/31/31	0/3/3/3

All (36) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	CPS	C32-S	-7.86	1.66	1.77
3	A	403	CPS	C32-S	-7.15	1.67	1.77
3	A	403	CPS	C30-N2	-5.01	1.42	1.52
3	A	403	CPS	C27-N2	-4.16	1.43	1.52
3	A	403	CPS	O2S-S	-4.14	1.33	1.47
3	A	403	CPS	C24-N1	-4.04	1.24	1.33
3	A	406[A]	CPS	C18-C6	-3.81	1.46	1.53
3	A	405	CPS	C11-C2	-3.79	1.47	1.54
3	A	406[A]	CPS	O3-C17	3.65	1.51	1.43
3	A	405	CPS	O4-C4	3.44	1.49	1.43
3	A	406[B]	CPS	C10-C5	3.43	1.60	1.54
6	A	410	SAH	O4'-C1'	3.34	1.45	1.41
6	A	410	SAH	C3'-C4'	-3.33	1.44	1.53
3	A	406[A]	CPS	C3-C4	-3.10	1.48	1.53
3	A	403	CPS	C27-C26	2.97	1.66	1.51
3	A	403	CPS	C22-C23	-2.89	1.43	1.52
3	A	403	CPS	C22-C20	-2.77	1.47	1.54
3	A	403	CPS	C25-N1	2.71	1.52	1.46
3	A	406[A]	CPS	C3-C19	-2.68	1.49	1.53
3	A	406[A]	CPS	C2-C19	-2.65	1.51	1.56
3	A	406[A]	CPS	C5-C9	-2.59	1.51	1.55
8	A	413	PRS	CD-N	2.55	1.51	1.45
3	A	404	CPS	O4-C4	2.54	1.47	1.43
3	A	406[B]	CPS	C8-C9	-2.48	1.49	1.54
3	A	406[A]	CPS	C18-C19	2.46	1.58	1.53
3	A	402	CPS	C16-C15	-2.37	1.50	1.53
3	A	405	CPS	C3-C19	2.34	1.57	1.53
3	A	406[B]	CPS	C14-C15	2.31	1.57	1.53
3	A	406[A]	CPS	C1-C2	-2.27	1.50	1.54
3	A	405	CPS	C5-C4	-2.19	1.51	1.54
8	A	413	PRS	CB-SG	2.17	1.88	1.81
3	A	404	CPS	C5-C6	-2.16	1.51	1.55

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	CPS	O1-C24	2.16	1.27	1.23
3	A	406[A]	CPS	C11-C2	2.10	1.58	1.54
3	A	403	CPS	C10-C5	-2.03	1.50	1.54
3	A	405	CPS	C16-C17	2.02	1.56	1.52

All (76) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	403	CPS	C27-C26-C25	-11.68	88.50	111.04
3	A	403	CPS	C25-N1-C24	-9.66	104.91	122.84
3	A	406[A]	CPS	C9-C5-C4	-5.79	112.38	117.67
3	A	403	CPS	C29-N2-C27	5.73	124.04	109.46
3	A	403	CPS	C23-C22-C20	-5.55	104.38	114.52
3	A	403	CPS	C26-C25-N1	5.46	127.83	112.21
3	A	406[B]	CPS	C9-C5-C4	5.38	122.58	117.67
3	A	405	CPS	C3-C19-C2	-5.03	108.54	113.73
3	A	406[A]	CPS	C14-C13-C12	-4.86	104.75	110.55
3	A	406[B]	CPS	C14-C15-C2	4.78	117.73	112.66
3	A	406[B]	CPS	C12-C1-C2	4.74	120.92	112.78
3	A	405	CPS	C15-C16-C17	-4.67	109.31	114.46
3	A	406[A]	CPS	C8-C9-C5	-4.65	98.99	103.55
3	A	403	CPS	C26-C27-N2	-4.56	105.72	115.38
3	A	406[A]	CPS	O4-C4-C3	-4.49	99.97	109.12
3	A	406[A]	CPS	C7-C6-C5	-4.49	99.15	103.55
3	A	403	CPS	O2S-S-O1S	4.18	121.50	111.27
3	A	406[B]	CPS	C16-C15-C14	-4.08	106.49	111.19
6	A	410	SAH	N3-C2-N1	-3.72	122.86	128.68
3	A	403	CPS	C5-C9-C20	-3.67	115.11	119.50
3	A	403	CPS	O1S-S-O3S	-3.61	101.45	113.95
3	A	405	CPS	C19-C3-C4	-3.58	109.57	114.30
3	A	406[A]	CPS	C19-C18-C17	3.52	116.09	111.88
3	A	406[B]	CPS	C10-C5-C9	-3.47	105.79	111.21
3	A	406[A]	CPS	C10-C5-C6	3.46	116.63	111.21
3	A	406[A]	CPS	C14-C15-C2	-3.45	109.00	112.66
3	A	406[A]	CPS	C3-C4-C5	3.36	114.69	111.24
3	A	403	CPS	C28-N2-C27	-3.17	101.41	109.46
3	A	406[B]	CPS	C7-C6-C5	3.15	106.65	103.55
3	A	402	CPS	C3-C19-C2	-3.10	110.53	113.73
3	A	402	CPS	C31-C32-S	2.96	117.78	113.25
3	A	403	CPS	C29-N2-C30	-2.93	102.00	109.46
3	A	402	CPS	C31-C30-N2	-2.92	109.20	115.38
3	A	406[A]	CPS	C9-C5-C6	2.89	103.01	100.09

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	413	PRS	CB-CA-C	2.88	115.42	111.32
3	A	406[A]	CPS	C5-C9-C20	-2.83	116.11	119.49
3	A	406[A]	CPS	C21-C20-C9	2.83	119.98	112.42
3	A	405	CPS	C19-C18-C17	-2.82	108.50	111.88
3	A	406[A]	CPS	C10-C5-C4	-2.82	106.20	109.07
3	A	402	CPS	C29-N2-C30	2.79	116.57	109.46
3	A	404	CPS	C8-C9-C5	-2.77	100.83	103.55
8	A	413	PRS	SG-CD-N	2.77	108.58	105.72
3	A	403	CPS	C10-C5-C9	-2.75	106.90	111.21
3	A	406[B]	CPS	C1-C2-C15	-2.73	103.72	107.77
3	A	406[B]	CPS	C1-C2-C19	2.71	115.61	111.35
3	A	406[A]	CPS	C16-C17-C18	-2.70	108.60	111.48
3	A	405	CPS	C11-C2-C1	-2.68	103.94	108.26
3	A	406[A]	CPS	C2-C19-C18	-2.68	108.94	111.82
3	A	406[A]	CPS	C3-C19-C18	2.65	114.76	110.88
6	A	410	SAH	C2'-C3'-C4'	2.55	107.60	102.64
3	A	403	CPS	C16-C17-C18	-2.53	108.78	111.48
3	A	406[A]	CPS	C11-C2-C1	-2.48	104.27	108.26
3	A	404	CPS	C2-C19-C18	-2.48	109.16	111.82
3	A	406[B]	CPS	C16-C17-C18	2.46	114.11	111.48
3	A	406[B]	CPS	C8-C9-C5	2.46	105.97	103.55
3	A	403	CPS	C21-C20-C22	2.43	114.17	110.36
3	A	403	CPS	C9-C5-C4	2.39	119.85	117.67
3	A	403	CPS	C7-C6-C5	2.36	105.86	103.55
3	A	405	CPS	C1-C2-C15	2.33	111.21	107.77
3	A	403	CPS	C22-C23-C24	2.31	118.21	113.04
3	A	405	CPS	C8-C9-C5	2.25	105.76	103.55
3	A	404	CPS	C21-C20-C22	-2.25	106.84	110.36
3	A	405	CPS	C22-C23-C24	-2.25	104.97	112.59
6	A	410	SAH	CB-CG-SD	2.24	118.33	113.31
3	A	402	CPS	C7-C6-C18	-2.23	115.21	118.33
3	A	406[A]	CPS	C22-C20-C9	-2.23	106.44	112.42
6	A	410	SAH	C5'-SD-CG	-2.19	95.69	102.27
3	A	403	CPS	C6-C5-C4	2.15	109.40	107.40
3	A	403	CPS	C8-C9-C5	2.10	105.61	103.55
3	A	404	CPS	C23-C22-C20	-2.09	110.69	114.52
3	A	405	CPS	C10-C5-C4	-2.06	106.97	109.07
3	A	403	CPS	O3S-S-C32	2.06	109.39	106.92
3	A	403	CPS	C28-N2-C30	2.05	114.67	109.46
3	A	402	CPS	C19-C18-C6	-2.03	106.92	109.71
3	A	406[A]	CPS	C3-C19-C2	-2.01	111.65	113.73
8	A	413	PRS	CB-SG-CD	-2.00	86.49	91.47

There are no chirality outliers.

All (10) torsion outliers are listed below:

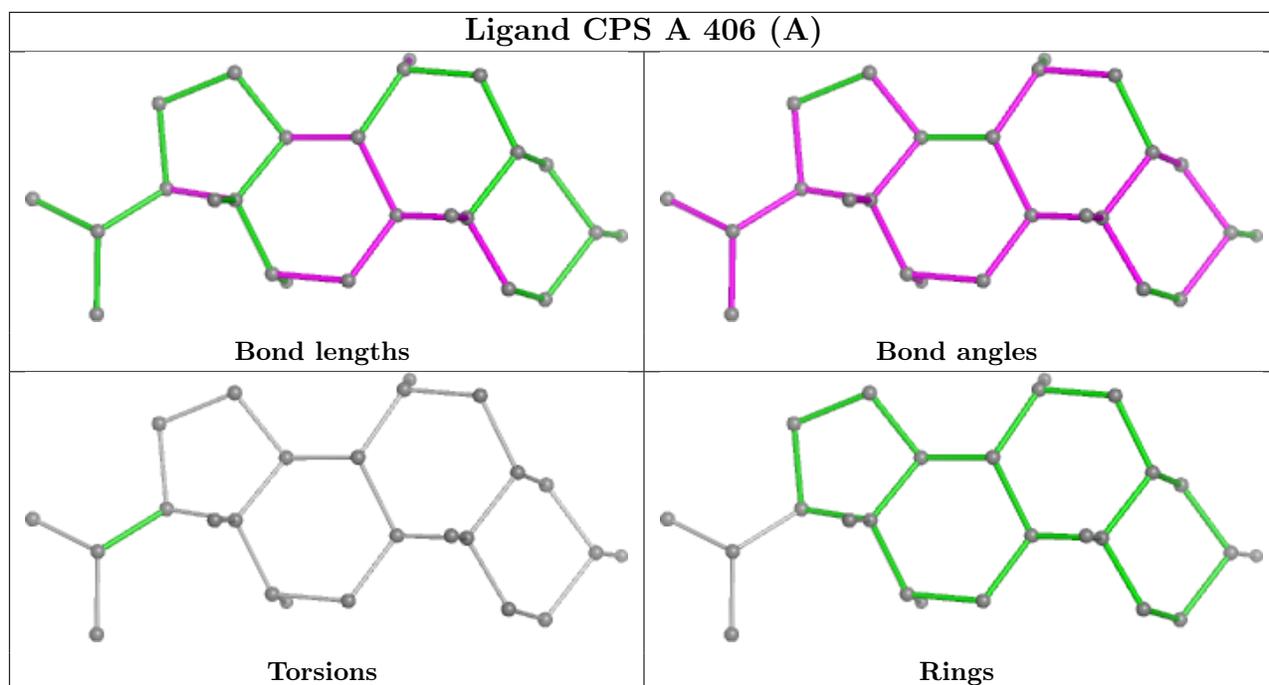
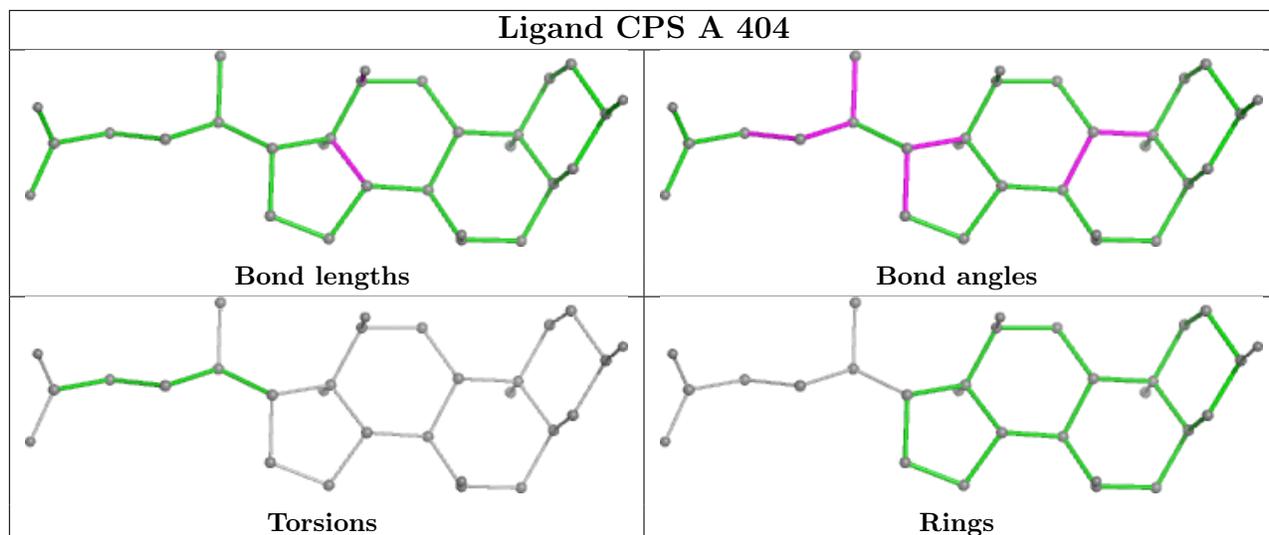
Mol	Chain	Res	Type	Atoms
3	A	403	CPS	C23-C24-N1-C25
3	A	403	CPS	O1-C24-N1-C25
3	A	403	CPS	C26-C27-N2-C28
3	A	403	CPS	C26-C27-N2-C30
3	A	403	CPS	C26-C27-N2-C29
3	A	403	CPS	C31-C32-S-O2S
3	A	403	CPS	C31-C32-S-O3S
6	A	410	SAH	C-CA-CB-CG
6	A	410	SAH	N-CA-CB-CG
8	A	413	PRS	O-C-CA-CB

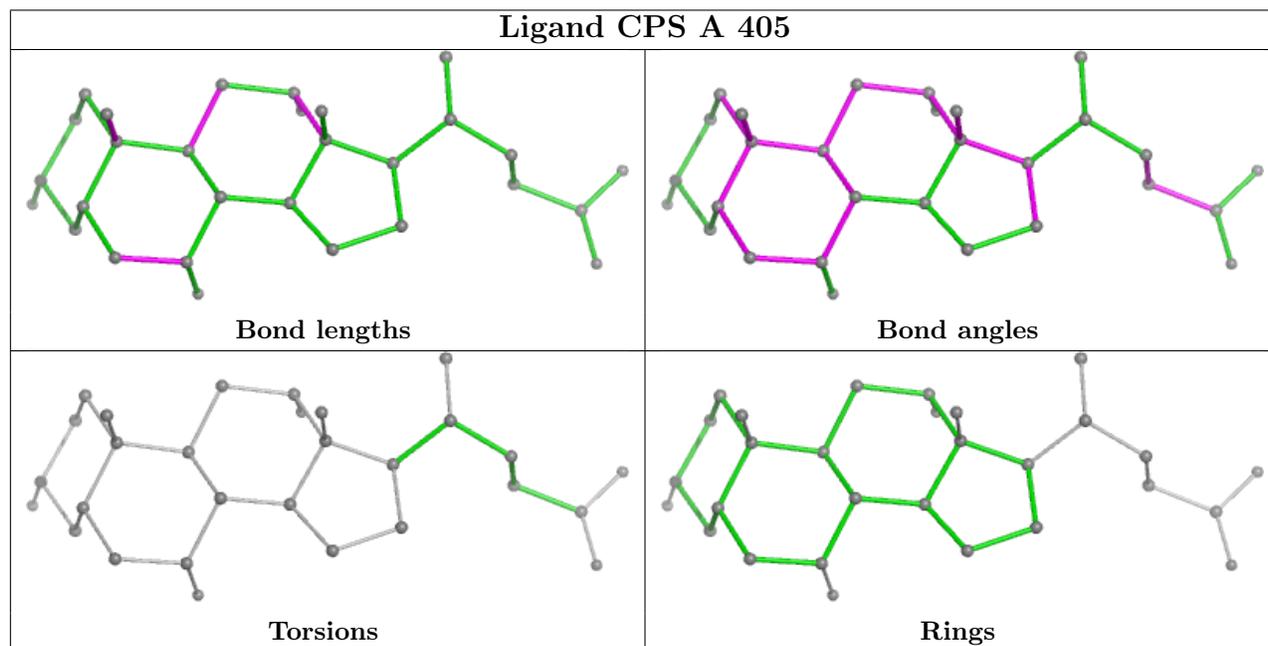
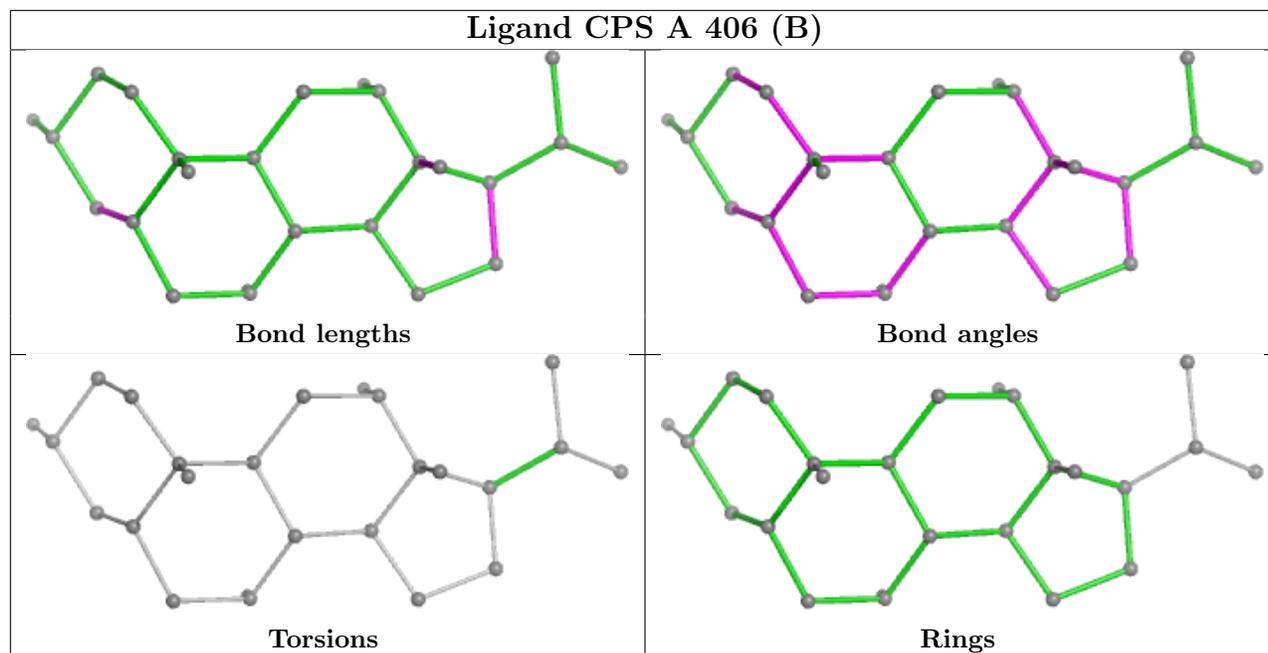
There are no ring outliers.

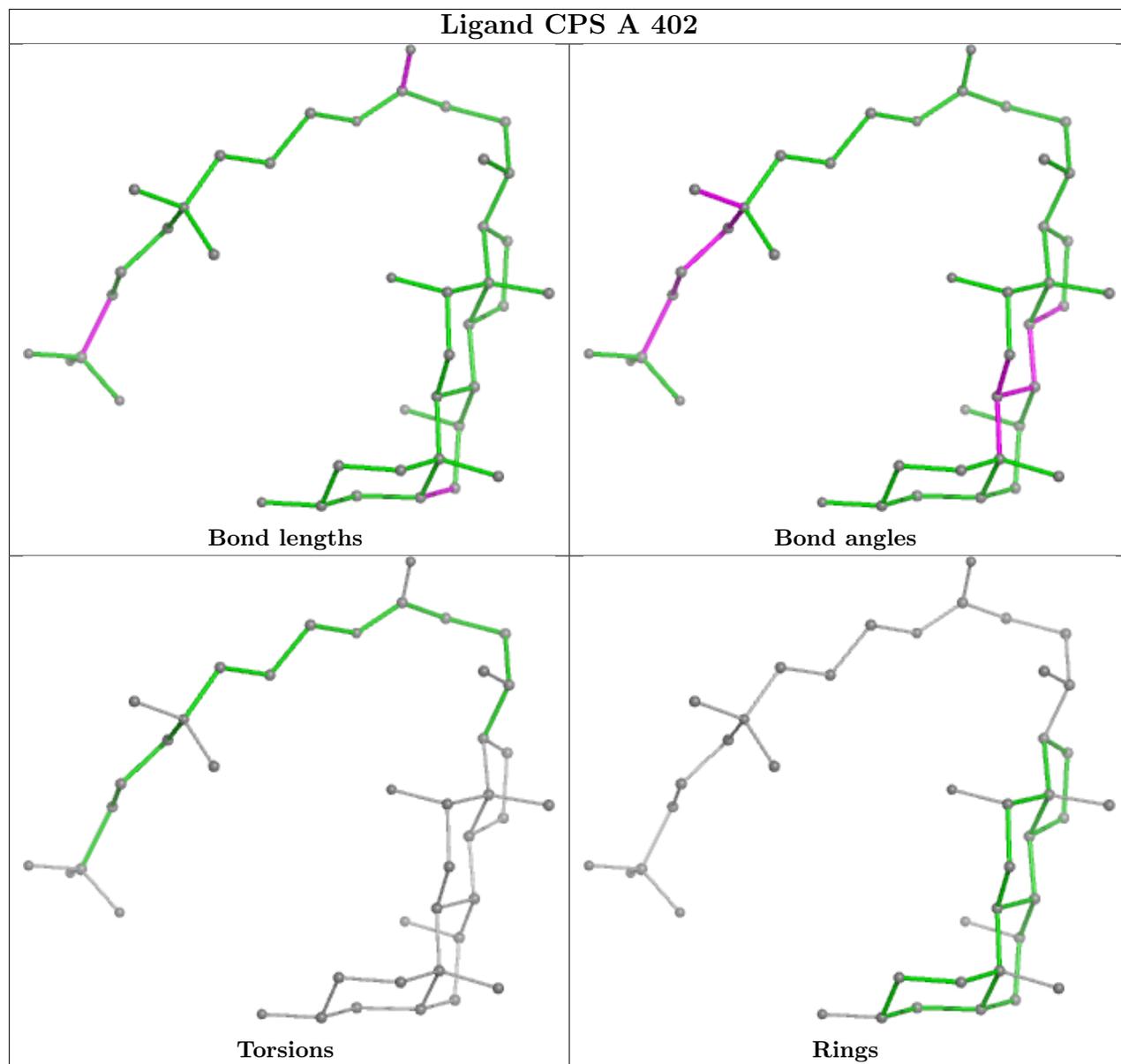
6 monomers are involved in 15 short contacts:

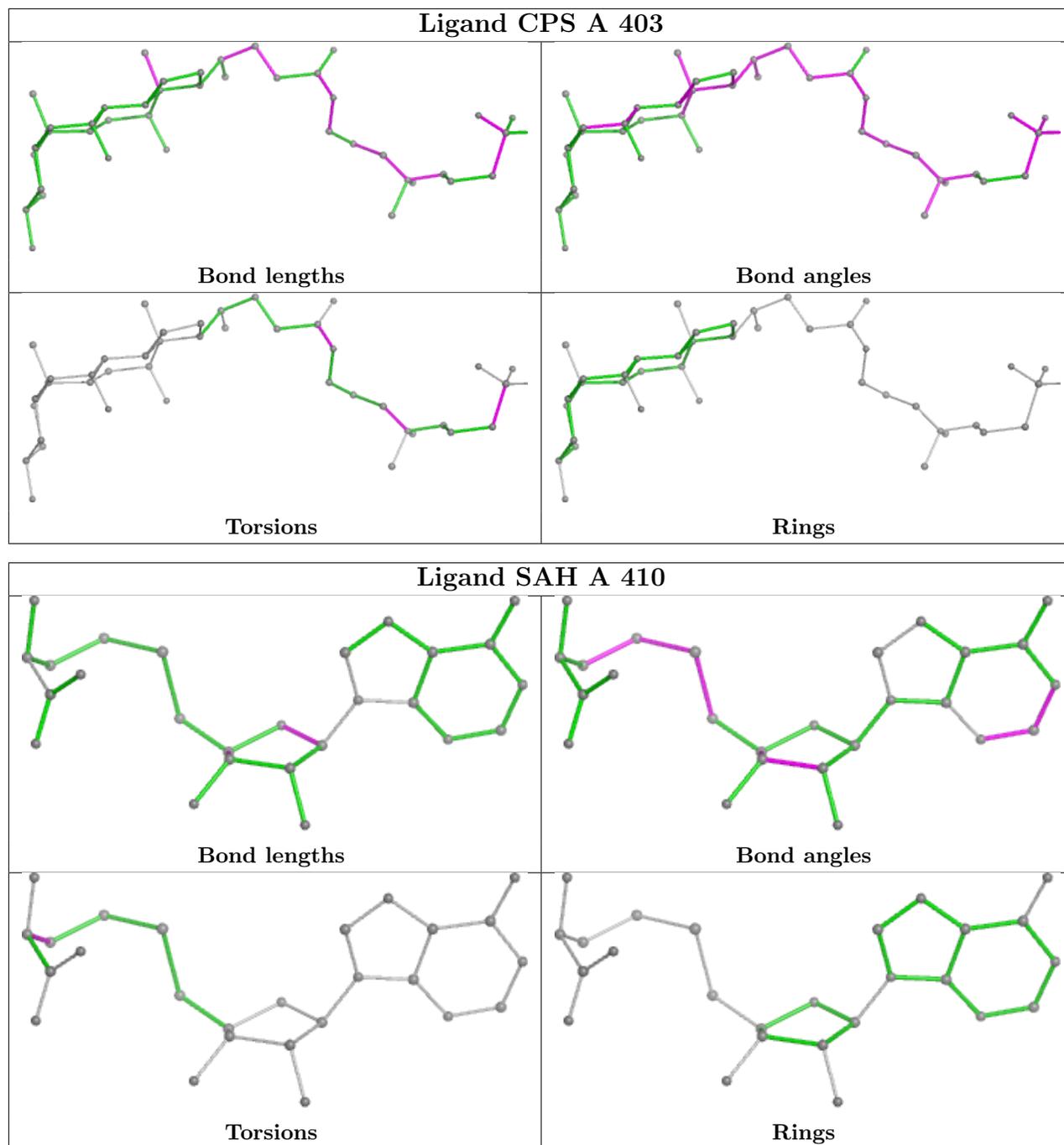
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	406[A]	CPS	2	0
3	A	406[B]	CPS	6	0
3	A	405	CPS	1	0
3	A	402	CPS	2	0
3	A	403	CPS	3	0
8	A	413	PRS	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	346/348 (99%)	0.06	9 (2%) 57 58	4, 13, 27, 45	44 (12%)

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	311	CYS	3.3
1	A	347	THR	3.0
1	A	27	ASN	2.5
1	A	308[A]	GLY	2.5
1	A	26	ILE	2.2
1	A	1	MET	2.2
1	A	310[A]	ILE	2.2
1	A	78[A]	ASN	2.2
1	A	309[A]	LYS	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	OTY	A	114[B]	13/14	0.84	0.11	11,13,16,19	13
1	OTY	A	114[A]	12/14	0.84	0.11	9,12,14,16	12

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands

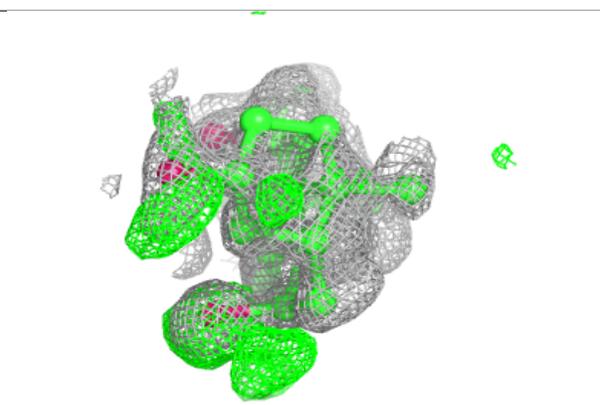
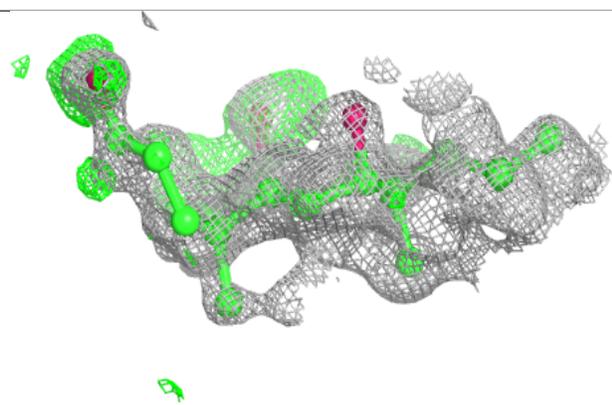
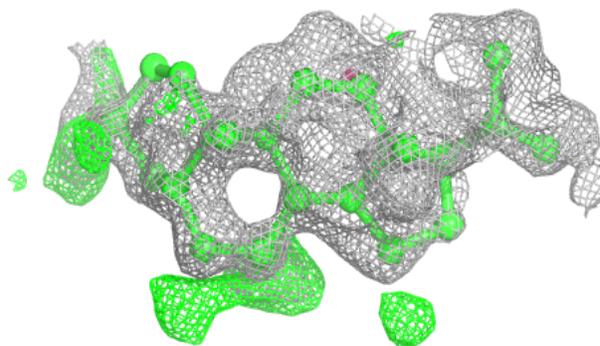
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	CPS	A	406[A]	25/42	0.81	0.14	9,12,14,16	25
3	CPS	A	406[B]	25/42	0.81	0.14	17,19,29,33	25
3	CPS	A	405	29/42	0.90	0.10	16,19,27,38	0
3	CPS	A	403	42/42	0.93	0.11	12,16,27,36	5
7	H2S	A	411[B]	1/1	0.94	0.11	24,24,24,24	1
7	H2S	A	412[B]	1/1	0.94	0.09	19,19,19,19	1
3	CPS	A	404	29/42	0.97	0.06	12,14,27,41	0
3	CPS	A	402	42/42	0.98	0.06	9,11,22,29	5
6	SAH	A	410	26/26	0.98	0.05	11,12,18,19	0
8	PRS	A	413	8/8	0.98	0.06	13,16,19,19	0
5	FES	A	409[A]	4/4	0.99	0.07	13,13,15,17	4
4	CL	A	408	1/1	1.00	0.05	14,14,14,14	1
2	SF4	A	401[A]	8/8	1.00	0.01	11,11,12,12	1
4	CL	A	407	1/1	1.00	0.04	13,13,13,13	0

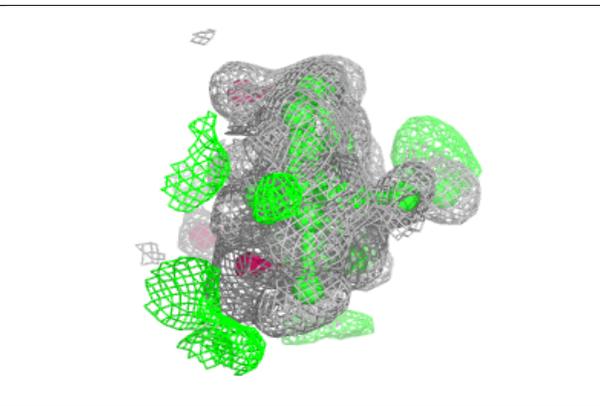
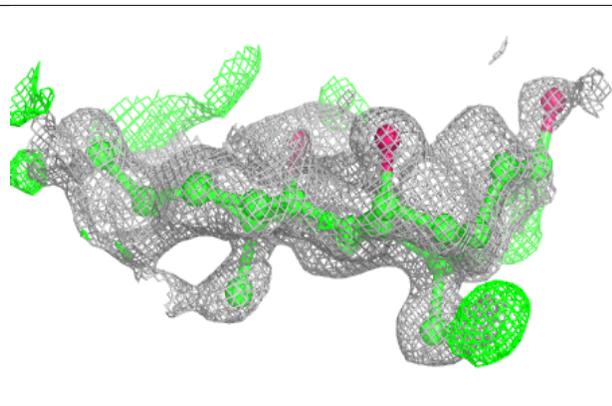
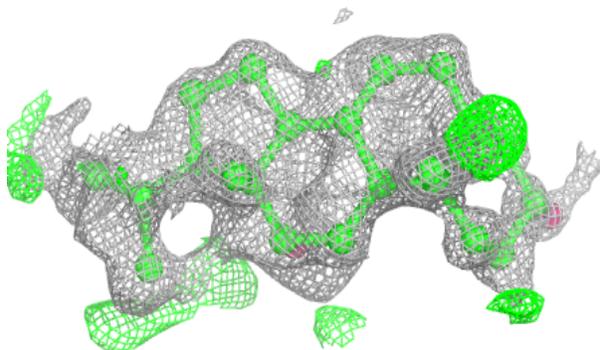
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around CPS A 406 (A):

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

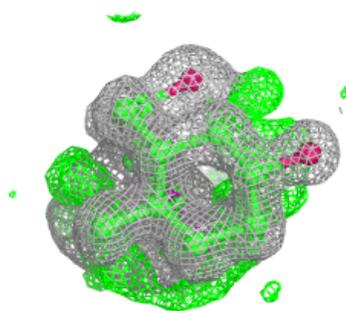
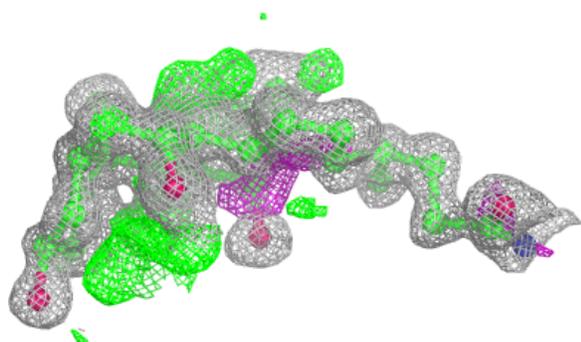
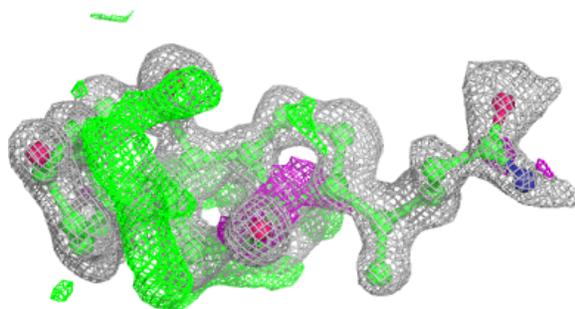
**Electron density around CPS A 406 (B):**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

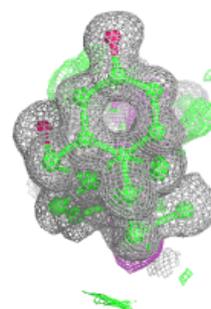
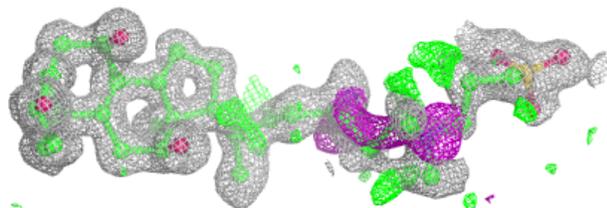
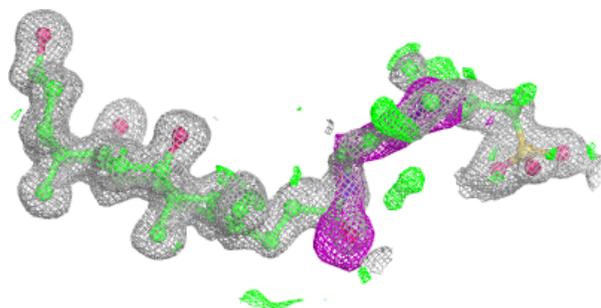


Electron density around CPS A 405:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

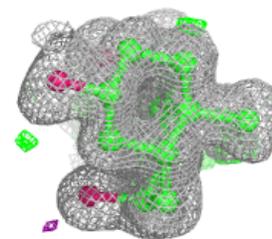
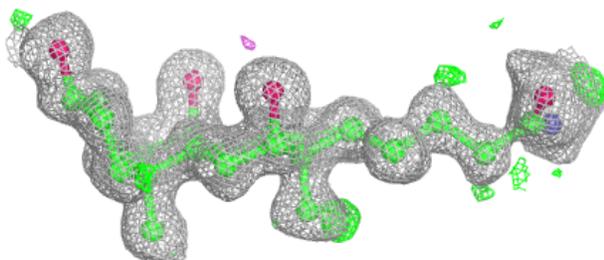
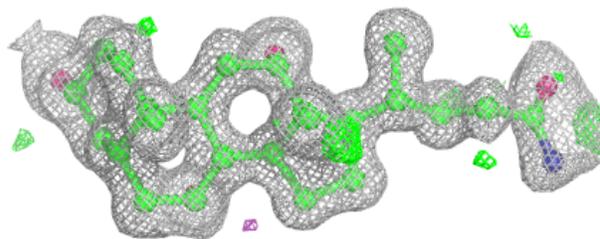
**Electron density around CPS A 403:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



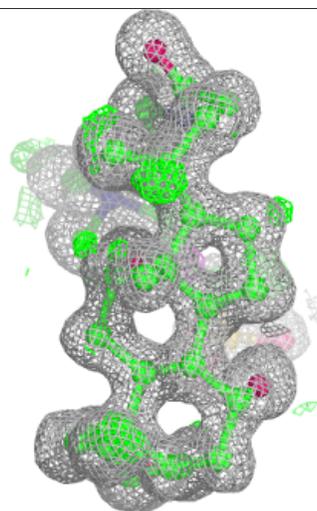
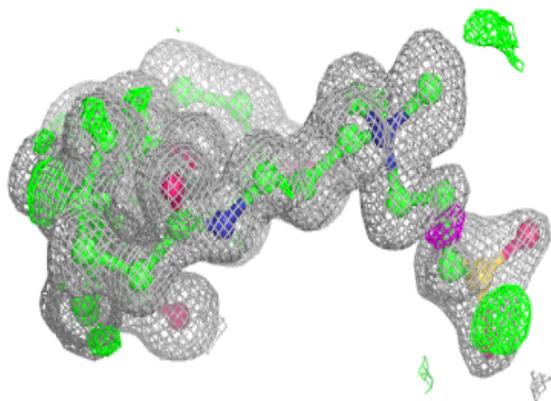
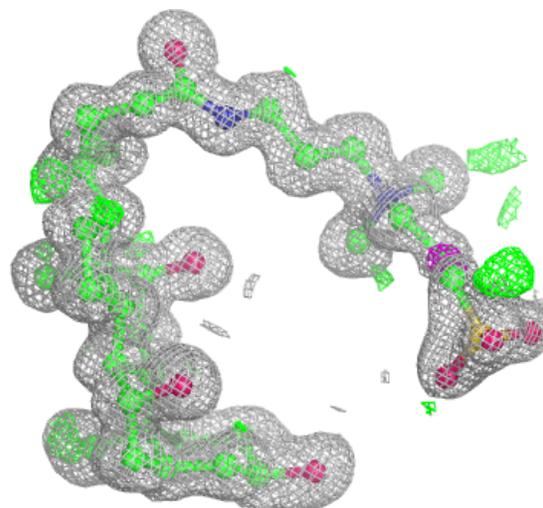
Electron density around CPS A 404:

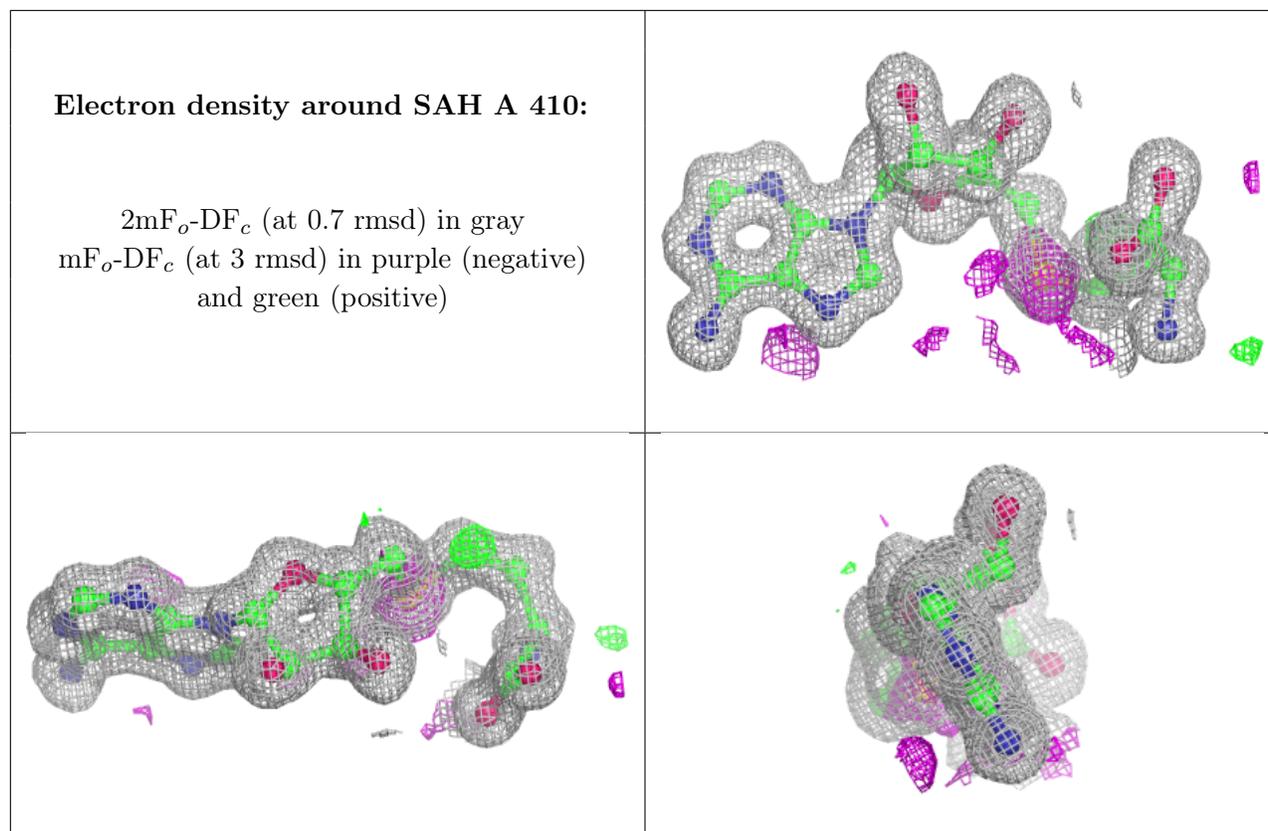
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around CPS A 402:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.